IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Art Unit 2809

In re application of	:	February 19, 2008
David M. Fried et al.	:	Examiner: Grant S. Withers
Serial No. : 10/538,911	:	
Filed: June 14, 2005	:	IBM Corporation Dept. 18G/Bldg, 300-482
Title: METHODS OF FORMING STRUCTURE AND SPACER AND RELATED FINFET	:	2070 Route 52 Hopewell Junction, NY 12533-6531

APPEAL BRIEF

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Sir:

This is an appeal from the September 18, 2007 Final Rejection of claims 1 - 18. A correct copy of the claims is attached in the Claims Appendix.

Real Party in Interest

The real party in interest is International Business Machines Corporation per an assignment recorded in the US Patent and Trademark Office at Reel/Frame: 016831/0926 on August 2, 2005.

Related Appeals and Interferences

None.

Status of Claims

Claims 1 - 18 are pending. Claims 19-21 were canceled previously. There are no other claims in the application.

Status of Amendments

No amendment after final rejection has been submitted.

Summary of the Claimed Subject Matter

The invention centers on structures that are especially useful in the formation of FinFET devices or other devices where erosion due to etch processes is problematic. The invention addresses the erosion problem by creating an overhang and building a spacer under the overhang. Applicants reference to the term "overhang" is illustrated in Figures 4 and 5 of the present application where the overhang (40, 140) is shown. The importance of the function of the overhang is discussed at paragraph [0004]. One embodiment of the formation of the overhang is discussed in paragraph [0020] and Figures 4A-B where overhang 40 is formed. Another embodiment for forming the overhang (140) is described in paragraph [0021] in connection with Figures 5A-B. Spacer (44) formation under the overhang is discussed in paragraph [0023] in connection with Figures 7A-B. Note at the end of paragraph [0023] that spacer (44) is protected by the overhang (40, 140). These portions of the specification describe the essential features of independent claims 1 and 14.

Grounds of Rejection to be Reviewed on Appeal

1. Claims 1-3, 6-9, 11 and 13 are rejected under 35 USC 102(b) as being unpatentable over US Pat. 5,512,517 (Bryant).

2. Claims 4-5 and 14-18 are rejected under 35 USC 103(a) as being unpatentable over Bryant in further view of US Pat. 6,960,806 (Bryant et al.).

3. Claim 10 is rejected under 35 USC 103(a) as being unpatentable over Bryant in further view of US Pub. App. 2002/0135041 (Kunikiyo)

4. Claim 12 is rejected under 35 USC 103(a) as being unpatentable over Bryant in further view of US Pat. 6,770,516 (Wu et al.)

Argument

1. Claims 1-3, 6-9, 11 and 13 are rejected under 35 USC 102(b) as being unpatentable over US Pat. 5,512,517 (Bryant).

Bryant (US 5512517) discloses a FET structure with a self-aligned sidewall spacer. The method of Bryant does not involve the formation of a spacer under an overhang, but rather formation of a layer over a preexisting spacer. In the method of Bryant, no portion of material is overhanging for a spacer to be formed under as required by the present claims. Rather, Bryant discloses that spacer material 22 is deposited first (Fig. 6), followed by formation of cap ox 30 and later the deposition of ox spacer film 32. It is not apparent to appellants how Bryant can be said to anticipate a step of forming a spacer under an overhanging structure as required

by the present claims where no overhanging structure exists at the time the spacer is formed in Bryant.

Appellants further submit that the reference to inherency in the official action regarding the limitation of present claim 6 (the step of making includes oxidation to form the overhang as a result of a differential oxidation rate of the second material (22) with respect to the first material (20)) is not well founded in as much as oxide spacer film 32 is deposited as a conformal coating. Thus, even if spacer film were to be further oxidized, it is not apparent that the result would be creation of an overhang. Thus, Bryant does not disclose or suggest creation of an overhang and forming a spacer under the overhang as required by the present method claims 1-3, 6-9, 11 and 13.

2. Claims 4-5 and 14-18 are rejected under 35 USC 103(a) as being unpatentable over Bryant in further view of US Pat. 6,960,806 (Bryant et al.).

The discussion of Bryant above is equally applicable regarding claims 4-5 and 14-18 which all require the step of forming a spacer under an overhang.

Bryant et al. (US 6960806) discloses a double gated vertical transistor with different first and second gate materials. Bryant et al. does not disclose or suggest any method wherein an overhang is formed, much less an overhang under which a spacer is subsequently formed. Thus, appellants submit that the combination of Bryant and Bryant et al. does not disclose or suggest the limitation of claims 4-5 and 14-18 where the creation of an overhang is required.

3. Claim 10 is rejected under 35 USC 103(a) as being unpatentable over Bryant in further view of US Pub. App. 2002/0135041 (Kunikiyo)

The discussion of Bryant above is equally applicable regarding claim 10 which requires the step of forming a spacer under an overhang.

Kunikiyo (US Pub App 2002/0135041) discloses a method of forming an overhang in a trench in embodiment 2. Since Bryant (US 5512517) does not disclose or suggest the formation of an overhang or a trench, it is not apparent how the teaching of Kunikiyo would lead one of ordinary skill in the art to form an overhang by reflow in the method of Bryant. At best, the combination of these references would result in the use of BPSG for the oxide spacer film 32 of Bryant. This, however, would still not result in the creation of the overhang nor the forming of a spacer under the overhang as required by present claim 10.

4. Claim 12 is rejected under 35 USC 103(a) as being unpatentable over Bryant in further view of US Pat. 6,770,516 (Wu et al.)

The discussion of Bryant above is equally applicable regarding claim 12 which requires the step of forming a spacer under an overhang.

Wu et al. (US 6770516) discloses a method of forming a FinFET with silicon nitride spacers. Wu et al. does not disclose or suggest the formation of overhangs, nor the formation of spacers under overhangs. Thus, in as much as neither Wu et al. or Bryant (US 5512517) contemplate the formation of overhangs, nor the formation of spacers under overhangs, appellants submit that the combination of Bryant (US 5512517) with Wu et al. would not result in a method involving the formation of overhangs nor the formation of spacers under overhangs as required by present claim 12.

Conclusion

Based on the above arguments, appellants submit that the present claims are patentable over the prior art of record and that the rejections under 35 USC 102(b) and 35 USC 35 USC 103(a) should be reversed.

Respectfully submitted,

David M. Fried et al.

By ___ /Steven Capella/ _____
Steven Capella, Attorney
Reg. No. 33,086
Telephone: 845-894-3669

Claims Appendix

Claims on Appeal

1. A method for forming a spacer (44) for a first structure (24, 124) and a spacer for at most a portion of a second structure (14), the method comprising the steps of:

depositing a first material (20);
forming a second material (22, 122) over the first material;
forming the first structure from the first and second materials;
making the second material overhang (40, 140) the first material; and
forming a spacer (44) under the overhang.

2. The method of claim 1, wherein the second structure (14) is made of monocrystalline silicon, and the first material (20) is made of polycrystalline silicon.

3. The method of claim 1, wherein the second material (22) is formed such that the second material has a faster oxidation rate than the first material.

4. The method of claim 3, wherein the second material includes a dopant including at least one of the group comprising: Arsenic, Germanium, Cesium, Argon and Fluorine.

5. The method of claim 3, wherein the second material is a deposited polycrystalline silicon-germanium alloy.

6. The method of claim 3, wherein the step of making includes oxidation to form the overhang as a result of a differential oxidation rate of the second material (22) with respect to the first material (20).

7. The method of claim 3, wherein the step of making includes forming oxide (34) on sides of the first structure (24) and the second structure (14).

8. The method of claim 1, wherein the second material (122) has different thermal reflow properties than the first material.

9. The method of claim 8, wherein the second material (122) is one of BPSG and PSG.

10. The method of claim 8, wherein the step of making includes heating the second material to cause the second material to reflow to form the overhang (40, 140).

11. The method of claim 1, wherein the step of forming the spacer (44) includes:

depositing a spacer material (42); and

directionally etching the spacer material away except under the overhang (40, 140).

12. The method of claim 11, wherein the spacer material (42) is at least one of silicon nitride or silicon oxide.

13. The method of claim 1, wherein the first structure (24, 124) is a gate and the second structure (14) is a fin of a FinFET (100).

14. A method for forming a gate structure (24, 124) and associated spacer (44) for a FinFET, the method comprising the steps of:

depositing a first gate material (20) over a fin of the FinFET;

forming a second material (22, 122) over the gate material, wherein the second material has a faster oxidation rate than the gate material;

forming the gate structure from the gate material and the second material;

oxidizing to cause the second material to overhang (40) the gate material; and

forming a spacer (44) under the overhang.

15. The method of claim 14, wherein the fin (14) is made of monocrystalline silicon and the gate material (20) is polycrystalline silicon.

16. The method of claim 14, wherein the second material (22) is a polycrystalline silicon formed such that the second material has a faster oxidation rate than the first material.

17. The method of claim 14, wherein the step of oxidizing also forms oxide (34) on sides of the fin (14) and gate structure (24).

18. The method of claim 14, wherein the step of forming the spacer (44) includes:

depositing a spacer material (42); and

etching the spacer material away except under the overhang (40).

19 - 21. Canceled.

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Evidence Appendix

None.

[End of Evidence Appendix]

Related Proceedings Appendix

None.

[End of Related Proceedings Appendix]